Chapter 5

PUMP, DE-ICING, DUNLOP, Mk. 3 SERIES

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Introduction

1. This type of pump is intended for the distribution of de-icing fluid on aircraft employing a 24-volt installation. Its design permits single or twin delivery fluid lines to be employed. Further information relating to this pump will be found in A.P.1803S, Vol. 1, Sect. 2.

DESCRIPTION

General

2. The complete unit consists of a motor and a pump assembly which are secured together and mounted on a pressed cradle or base (*fig.* 1). The end face of the pump body is fitted with an inlet pipe and two

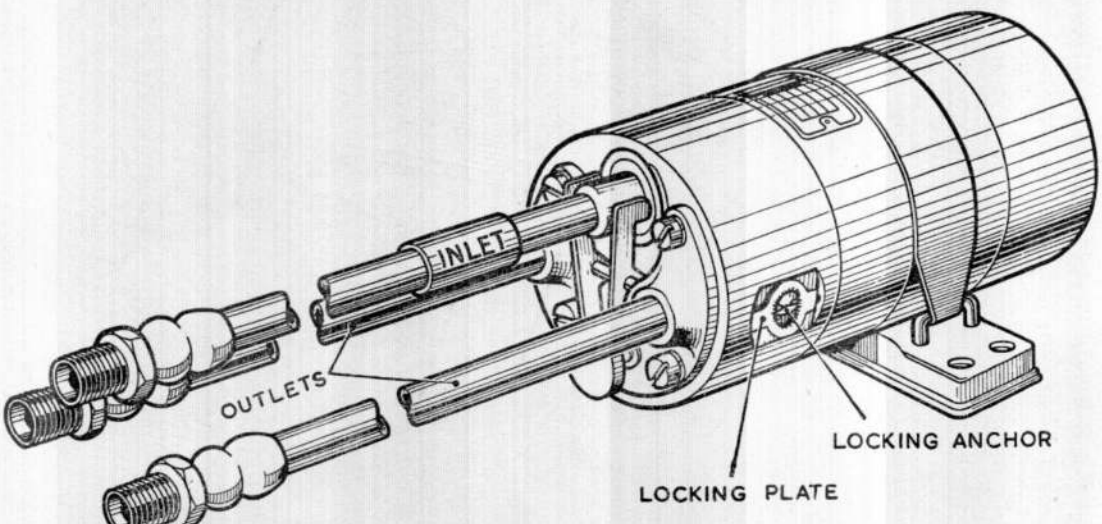

Fig. 1. External view of pump

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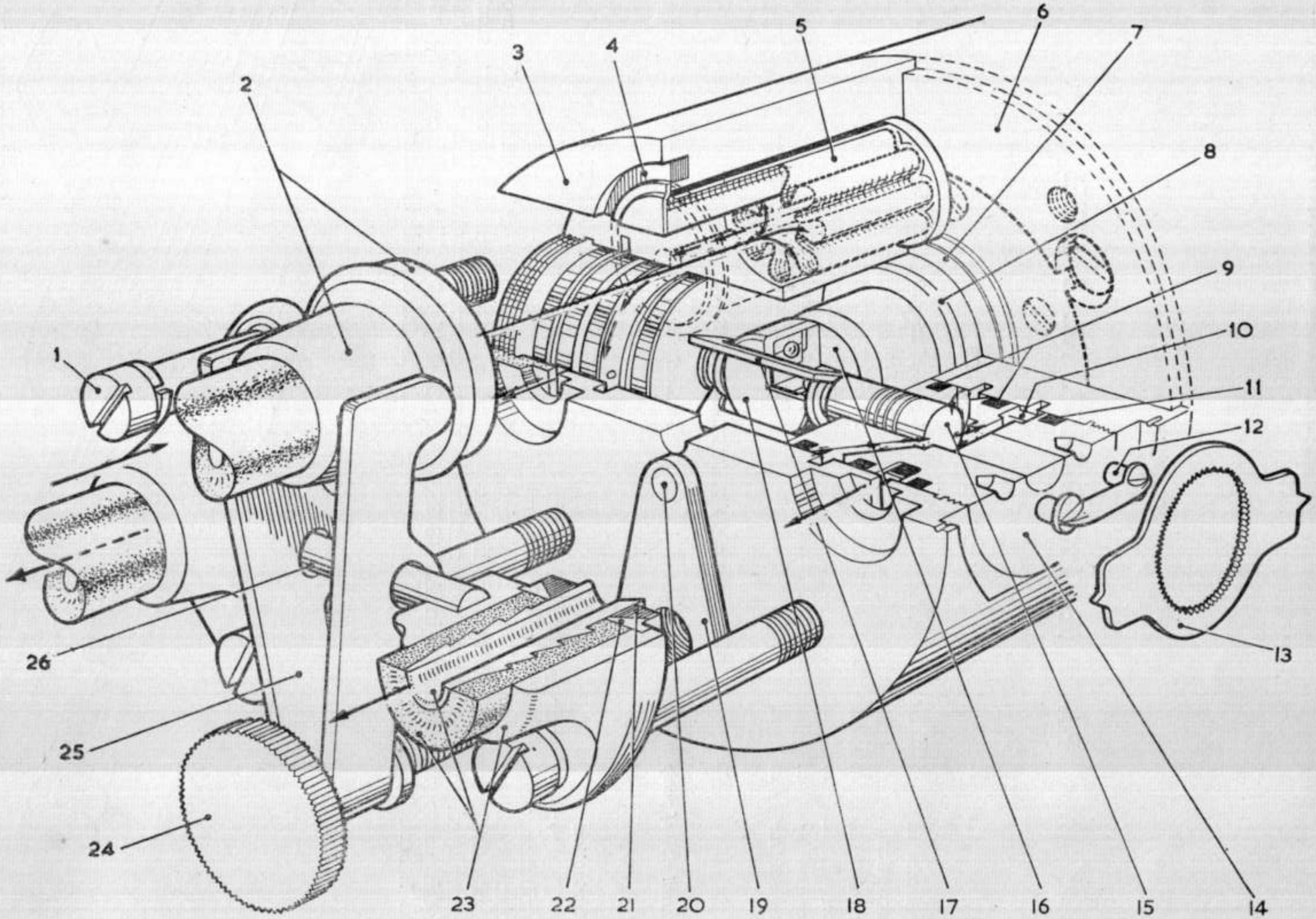

KEY TO FIG. 2

1 PUMP BODY AND HOSE RETAINING BOLT
2 INLET HOSE ASSEMBLY (INTEGRAL WITH FILTER COVER)
3 PUMP BODY
4 FILTER COVER SEALING RING
5 FILTER
6 MOTOR DRIVE FACE
7 SEALING RING
8 DISHED WASHER
9 SEALING WASHERS
10 DELIVERY VALVE RING
11 SEALING RING
12 CYLINDER LOCKING ANCHOR
13 LOCKING PLATE
14 CYLINDER BODY
15 PISTON
16 ECCENTRIC
17 PISTON LINK
18 ECCENTRIC BEARING DRUM
19 ANCHOR PLATE
20 ANCHOR PLATE RETAINING PEG
21 GLAND PACKING RING
22 GLAND CLAMPING RING
23 HOSE CLAMP
24 KNURLED SCREW
25 INLET HOSE CLAMPING LEVER
26 LEVER PIVOT

Fig. 2. Sectional view of pump assembly

delivery pipes. The maximum rate of fluid supply is adjustable within the range of 7 to 16 pints per delivery point per hour, at a back pressure of 12 lb. per sq. in. In instances where a single delivery line is required, one or the other of the delivery pipes must be removed and replaced by a blank and a hose clamp.

Motor

3. The 24-volt series-wound d.c. motor is cylindrical in form and is entirely flame-proof. The armature rotates in ball bearings and its shaft projects from the drive end of the motor body. A terminal block is fitted at the commutator end of the motor body, and this, as well as the two brush inspection apertures, is enclosed by a cover which is fitted with a central gland suitable for Dumet 4 cable. Each of the commutator brushes is retained by a split pin which facilitates inspection and renewal of the brushes.

Pump assembly (*fig. 2*)

4. The pump assembly comprises a cylindrical light alloy body within which the pump mechanism is accommodated. The motor end of the pump body is machined to seat on the motor drive face, and the other end of the body is machined to receive the inlet and delivery hose assemblies. A dished washer (8) is fitted on the armature shaft projecting from the drive end of the motor. This washer locates a rubber ring which seals the mouth of the central bore in the pump body. A boss, one end of which is reduced to form an eccentric (16), is fitted on the projecting end of the motor shaft and is secured by a rivet, so that it is accommodated in the central bore of the pump body. The eccentric carries a small ball bearing over which is pressed a steel cap or drum (18). The eccentric locates in the space between the two cylinders, one of which is screwed into each end of a large diameter bore in the pump body. In each of the cylinders is a piston which has a groove at the end nearest to the eccentric chamber. These grooves are engaged by a rigid link (17) which couples the pistons and holds them in contact with the bearing drum on the eccentric. By this means, rotation of the eccentric causes both pistons to reciprocate in their cylinders. The pistons, which are identical, have three shallow circumferential grooves about half-way along their length.

KEY TO FIG. 2

1 PUMP BODY AND HOSE RETAINING BOLT	7 SEALING RING	14 CYLINDER BODY	21 GLAND PACKING RING
2 INLET HOSE ASSEMBLY (INTEGRAL WITH FILTER COVER)	8 DISHED WASHER	15 PISTON	22 GLAND CLAMPING RING
3 PUMP BODY	9 SEALING WASHERS	16 ECCENTRIC	23 HOSE CLAMP
4 FILTER COVER SEALING RING	10 DELIVERY VALVE RING	17 PISTON LINK	24 KNURLED SCREW
5 FILTER	11 SEALING RING	18 ECCENTRIC BEARING DRUM	25 INLET HOSE CLAMPING LEVER
6 MOTOR DRIVE FACE	12 CYLINDER LOCKING ANCHOR	19 ANCHOR PLATE	26 LEVER PIVOT
	13 LOCKING PLATE	20 ANCHOR PLATE RETAINING PEG	

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5. The outer face of each cylinder has two holes to permit the insertion of a special key whereby the cylinder may be adjusted to provide the requisite output from the pump. When the pump has been assembled and calibrated, the cylinders are each locked by a pegged locking anchor (12) which is retained in position and prevented from rotating by a spring plate (13). This plate has two diametrically opposite lugs which are sprung into holes in the pump body and so hold it in position. A degree of adjustment is afforded by teeth on the anchor which engage with the serrations on the inner edge of the locking plate.

6. Each of the cylinders has three sealing rings in grooves on its outer circumference. Between the middle and outer sealing rings a rubber ring is located in a deep rectangular section groove from which a radial hole communicates with the closed end of the cylinder bore. Lateral clearance between the rubber ring and its accommodating groove forms a non-return delivery valve through which the displaced fluid in the cylinder is discharged. Another groove, of V-section, is located between the middle and inner sealing rings on the outer periphery of the cylinder. This groove is connected by two oblique radial slots or ducts to a groove in the inner wall of the cylinder and so provides the inlet to the cylinder. The inlet groove and the delivery valve grooves each registers with a peripheral groove or channel in the diametric bore in the pump body. The delivery grooves communicate with two counter-bored recesses in the end face of the pump body, and the inlet grooves connect through drilled ducts, to the inlet filter chamber. This chamber is in direct communication with the inlet hose assembly.

Hoses and filter

7. The delivery hose assemblies are secured by ch/hd. bolts to the end face of the pump, so that the hoses register with counter-bored recesses; these bolts also secure the pump to the motor. Fluid-tight joints are made by a rubber packing ring on each hose spigot. This packing ring is compressed by a gland clamping ring which is interposed between the hose clamp and the packing ring.

8. The filter is housed in a longitudinal bore, the open end of which is located over and between the delivery apertures in the body. The filter consists of a cylindrical axially corrugated gauze element soldered between two end discs. The smaller of the discs is that which is to be inserted into the filter chamber. The larger disc has a central hole through which fluid is admitted to the pump.

9. The pump end of the inlet hose has an integral filter cover, which seats on to a rubber sealing ring located in a groove concentric with the mouth of the filter chamber. The inlet hose is retained by the forked end of a lever which pivots on a pin supported between drilled bosses on the two delivery hose clamps. A knurled screw, which engages in a self-locking anchor plate pinned to the pump body, loads the lever and secures the end of the inlet hose to the inlet aperture. The ends of all three rubber hoses are fitted with $\frac{1}{4}$ in. B.S.P. standard nipple adapter pipe connections.

Method of using single delivery

10. In the event of only one delivery being required from the pump, the middle sealing ring and the rubber delivery ring are omitted from one of the cylinders. The corresponding delivery hose is replaced by a hose clamp and a blank which is sealed by a rubber gland.

Operation

11. When the pump motor is energized, the pump eccentric rotates and causes the pistons to reciprocate in their cylinders. Considering one cylinder only, it is so positioned that when its piston nears the end of its induction stroke, i.e., moving out of the cylinder, it uncovers the groove in the cylinder wall and thereby permits fluid to enter the space above the crown of the piston. During the return stroke, the piston covers the inlet aperture and forces the fluid in the cylinder past the delivery valve ring to the delivery pipe. This cycle is repeated by the successive strokes of the piston. The path taken by the fluid is shown by red arrows in fig. 2. The quantity of fluid discharged by each delivery stroke of the piston is dependent upon the distance travelled by the piston before it covers the inlet aperture. By screwing the cylinder further into the pump body, the inlet aperture is covered earlier in the stroke, thereby increasing the rate of delivery. Conversely, by screwing the cylinder further out of the body, the rate of delivery will be decreased.

SERVICING

Motor

12. The normal procedure for servicing electric motors (*A.P.*4343, *Vol.* 1, *Sect.* 18) is applicable, and it is recommended that reference be made to A.P.4343, Vol. 1, Sect. 1, Chap. 1. Servicing may be effected by loosening the cable gland nut on the end of the motor cover and then removing the two pinnacle nuts holding the motor cover in position. The cover may then be slid off the motor body, thereby giving access to the connections, brushes and commutator. Brushes which are chipped at the commutator end or are worn to a length of $\frac{7}{8}$ in. (measured from the shoulder to the trough in the contact face) are to be deemed unserviceable.

Inhibiting installed pumps

13. If certain fluids are contained in the pump for long periods when it is out of use, it is possible that corrosion of the cylinders and pistons may occur. If it is anticipated that the pump is likely to remain unused for some time, it must be inhibited with Lockheed fluid No. 22 in the following manner. Drain the supply tank of de-icing fluid and introduce a quantity of Lockheed fluid. Then run the pump at full output until pure inhibitor is discharged from all delivery points. An installed pump which has been treated in this manner requires no further servicing other than security checks and short test runs.

Inhibiting for temporary storage

14. Instances might occur where Mk. 3 de-icing pumps are to be removed from aircraft and stored for an indefinite period. Under such circumstances, the pump must be inhibited by filling it with Lockheed No. 22 fluid to prevent the seizure of pistons, due to the congealing of residual de-icing fluid during periods of storage. Unions should be sealed by suitable blanking plugs, e.g., outer sleeve AGS904B, nipple plug AGS11404 and split pin, B.S. S.P.9/C4.

15. At the end of each six months' storage, de-icing pumps should be connected to a tank of Lockheed fluid, No. 22, with the pump outlet connected back to the tank. The pump should then be connected to a nominal 24-volt d.c. supply and given a short run of approximately 30 seconds. After running, ensure that the pump is again filled with Lockheed fluid and sealed off before return to store.

Note . . .

*Filters for these de-icing pumps are supplied as separate units in metal containers (AHO.*16810), *and when pumps are stored after service the filters should be removed, cleaned with hot water and placed into the containers until required. In no circumstances should filters be left in pumps under storage conditions.*

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